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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: Christopher J. Bulian et al. Docket No.: S-100,500
Serial No.: 10/629,489 Examiner: Paul A. Wartalowicz
Filed : July 28, 2003 Art Unit: 1754
For : PREPARATION OF TUNGSTEN OXIDE

Mail Stop Appeal Brief - Patents
Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF REPLY BRIEF

1. Transmitted herewith is the Reply Brief in this application with respect to the Examiner's Answer mailed on July 27, 2007.
2. ☐ Applicant claims small entity status.

Respectfully submitted,

Date: September 27, 2007

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

Appellants: Christopher J. Bulian et al.

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REPLY BRIEF

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STATUS OF CLAIMS

Claims 1-10 are pending in the application. Pending claims 1-10 have been finally rejected in the Office Action dated April 19, 2005. The rejection of claims 1-10 is appealed. No claims have been allowed.

GROUND OF REJECTION TO BE REVIEWED ON APPEAL

(1) Whether claims 1-6 and 8-10 were properly rejected under 35 U.S.C. § 103(a) over Redanz (US 2,993,755) ("Redanz") in view of Baresel et al. (US 3,902,917) ("Barasel");

(2) Whether claim 7 was properly rejected under 35 U.S.C. § 103(a) over Redanz in view of Baresel and Sato (US 3,452,106) ("Sato"); and

(3) Whether claim 10 was properly rejected under 35 U.S.C. § 102(b)/103(a) over Sherman (US Patent Application 2002/0005145) ("Sherman").

The Examiner's Answer filed July 27, 2007 maintains the rejections to claims 1-10.

ARGUMENT

1. Appellant's claimed subject matter relates to the following areas: (i) to a solution of ammonium paratungstate and HCl (claim 1), (ii) to preparing the solution by combining ammonium paratungstate with hydrochloric acid (claims 2 and 3, (iii) to methods that involve first preparing the solution and then using the solution to form tungsten oxide monohydrate ($\text{WO}_3 \cdot \text{H}_2\text{O}$) (claim 4) or anhydrous tungsten oxide (WO_3 , WO_2) (claims 5-7), and (iv) to nanoparticles and nano-sized platelets of tungsten oxide hydrate (claims 8 and 9) and nano-sized platelets of tungsten oxide (claim 10).

2. It was argued that Appellant's solution of claim 1 and method for forming of claims 2-3 are unpatentable because

- (i) Redanz teaches forming a slurry by mixing ammonium paratungstate with HCl;
- (ii) a slurry and a solution are equivalents; and therefore
- (iii) Redanz's slurry of ammonium paratungstate and HCl renders Appellant's claimed solution and method for forming obvious because a slurry is "a colloidal solution wherein particles are suspended in the liquid (water)".

3. Appellant respectfully disagrees because "solution" and "slurry" are not equivalents. A solution by definition is a homogeneous mixture having a single phase while a slurry has both a liquid phase and a solid phase. The interpretation of equivalence of solution and slurry is also inconsistent with Redanz own teachings (see EXAMPLE 1 of Redanz).

4. It was also argued that Appellant's solution (claim 1) and method for forming (claims 2-3) are unpatentable because:

- (iv) Redanz in EXAMPLE III adds a slurry of water and ammonium paratungstate to concentrated chemically pure hydrochloric acid, then agitates the slurry in a 4-liter beaker for 2 to 3 hours at 75-85°C, then allows the slurry to stand for a 24-hour period to settle and cool; and

- (v) Redanz describes the product as “the resulting solution”; and therefore
- (vi) Redanz discloses a solution comprising water, ammonium paratungstate, and concentrated hydrochloric acid.

5. Appellant respectfully disagrees with this argument because Redanz does not teach or suggest that this “resulting solution” contains any ammonium paratungstate. Redanz, in EXAMPLE III, discloses forming a slurry from ammonium paratungstate and water, combining this slurry with concentrated HCl to form a different slurry, and heating at 75-85°C for 2-3 hours. Even after the heating step, the solids do not dissolve. So Redanz cools the slurry for a 24-hour period, which allows the solids to settle out. Redanz refers to the supernatant as a solution. Redanz decants the supernatant, which is clearly a waste product, leaving a “yellow cake of tungstic acid”. Redanz does not teach or suggest that there is any ammonium paratungstate dissolved in the supernatant. Furthermore, Appellant is not claiming a method for forming a solution that is a waste product.

6. It was also argued that the “comprising” type open language of claim 2 does not exclude water or a slurry and therefore teaches the invention as claimed. Appellant agrees that the preparation includes water because the HCl itself is an aqueous solution of hydrochloric acid. Appellant’s claim 2, however, does not call for adding any additional water. Furthermore, Applicant disagrees that claim 2 does not exclude a slurry. The claim calls for the preparation of a solution, not a slurry.

7. It was argued that claim 3 is unpatentable over Redanz in view of Baresel. Claim 3 is drawn to a method for forming a solution of ammonium paratungstate and hydrochloric acid wherein the hydrochloric acid is concentrated. Nowhere does the prior art teach or suggest that mixing concentrated HCl with ammonium paratungstate forms a solution. If the prior art taught mixing of concentrated HCl with ammonium paratungstate, then the product would have been a solution. Redanz and Baresel issued more than 40 years ago (Redanz was filed nearly 50 years ago). Thus, for more than 40 years, it has been known that mixing ammonium paratungstate with

hydrochloric acid in the manner disclosed in these references produces a slurry. How obvious to one skilled in the art can it be based on the prior art that mixing ammonium paratungstate with concentrated hydrochloric acid would produce a solution? Applicant submits that Appellant's method of claim 3 is not obvious based on the combined teachings of Redanz and Baresel.

8. It was argued that claims 4-6 are unpatentable over Redanz in view of Baresel. Claims 4 is drawn to a method for preparing $\text{WO}_3 \cdot \text{H}_2\text{O}$, and claims 5-6 are drawn to a method for preparing anhydrous WO_3 nanopowder. Claim 4 involves preparing a precursor solution of ammonium paratungstate and combining the solution with water to form a precipitate of $\text{WO}_3 \cdot \text{H}_2\text{O}$. Claim 5 involves these steps and also the step of heating the precipitate to form anhydrous tungstic oxide (WO_3), and Claim 6 depends from claim 5 and also includes some temperature limitations for the heating step. It was argued that the combination of Redanz and Baresel teach a substantially similar process of mixing water with 37% HCl and ammonium paratungstate to form a precipitate and heating the precipitate at the claimed temperature range and that the product produced by the prior art is substantially similar to the claimed product and is in the form of a nanopowder.

9. Appellant disagrees that the processes are substantially similar. The prior art does not teach or suggest preparing a solution of HCl with ammonium paratungstate and then combining the solution with water to form a precipitate. Furthermore, the prior art product is different from Appellant's product. Appellant's product is tungsten oxide hydrate ($\text{WO}_3 \cdot \text{H}_2\text{O}$) while the prior art product is tungstic acid. Moreover, it would have been impossible to predict that by first forming a solution of ammonium paratungstate and hydrochloric acid, and then adding water to the solution to precipitate a solid from the solution that the precipitate would be tungsten oxide hydrate, and not tungstic acid. Furthermore, the prior art does not teach or suggest a process for making nanopowder.

10. It was argued that Claim 7 is unpatentable over Redanz in view of Baresel and Sato. It was argued that Redanz in view of Baresel taught the claimed process except

for the step of using hydrogen, and that Sato teaches making an oxide of tungsten of lower valency than WO_3 using hydrogen. Appellant respectfully disagrees because none of the prior art, alone or in combination teach or suggest preparing a precursor solution of ammonium paratungstate and hydrochloric acid and then combining the precursor solution with water to form a precipitate.

11. According to page 8 of the previous Office Action, "tungstic acid is hydrated tungsten oxide". In this Examiner's Answer, however, the Office Action states on page 16 that tungstic acid is **not** hydrated tungsten oxide, explaining that the previous Office Action was not arguing that tungstic acid and tungsten oxide are the same material but instead that the process of the prior art is substantially similar to that of the claimed invention, and therefore the product by the prior art process is substantially similar to product of the claimed invention. Applicant disagrees that the processes are substantially similar. The prior art process is forming a slurry and using the slurry to prepare tungstic acid while the presently claimed invention involves forming a solution followed by precipitating tungsten oxide hydrate from the solution. Thus, the processes are not substantially similar. The products are also not similar. Tungstic acid and tungsten oxide hydrate may have the same chemical composition but they are different chemical compounds with different chemical and physical properties. It is well known in the art that materials can have the same chemical composition yet have different chemical and physical properties. This makes the products isomers. It does not make the products similar.

12. In the first Office Action dated April 6, 2006, on page 5, it was argued that Baresel's use of the term "finely divided" in EXAMPLE 1 (column 4, lines 43-47) inherently teaches nanoparticles. Later, in the second/final Office Action dated October 30, 2006 page 5, and also in the present Examiner's Answer on page 12, it is stated that (1) "finely divided" is not relied upon to teach inherency of nanosized particles of tungsten oxide, and (2) Appellant admitted that finely divided is associated with nanoparticles. Appellant made no such admission. In Appellant's response dated August 7, 1006, Appellant submitted that finely divided might be associated with powder

particles that are millimeter sized, micron sized, or nanosized. This is not an admission that finely divided is associated with nanoparticles. This is an admission that “finely divided” might be associated with particles in the entire range of particle sizes, irrespective of their particular size.

13. It was argued that claim 9 is unpatentable over Redanz in view of Baresel. Claim 9 is drawn to nanoparticles of tungsten oxide monohydrate ($\text{WO}_3 \cdot \text{H}_2\text{O}$) having a platelet morphology. Neither Redanz nor Baresel, alone or in combination, teach or suggest tungsten oxide monohydrate nanoparticles having platelet morphology. Moreover, neither Redanz nor Baresel, alone or in combination, teach tungsten oxide monohydrate particles of any size.

14. It was argued that claim 10 is unpatentable over Redanz in view of Baresel. Claim 10 is drawn to nanoparticles of tungsten oxide (WO_3) having a platelet morphology. Neither Redanz nor Baresel, alone or in combination, teach or suggest tungsten oxide nanoparticles having platelet morphology.

15. It was argued that claim 10 is unpatentable under 35 U.S.C. § 102(b)/103(a) over Sherman. It was argued that Sherman teaches photocatalyst particles having a size of 1 to 100 nanometers made of tungsten oxide having platelet morphology (paragraph 0206, lines 4-5; paragraph 0208, lines 1-3; paragraph 0209, lines 10-13). It was argued that if Sherman does not inherently teach nanosized particles of tungsten oxide having platelet morphology, one of ordinary skill in the art would recognize that it would be obvious to produce nanosized particles of tungsten trioxide having a platelet morphology based on the desired properties of the end product and that the limited number of combinations from the lists (compounds and geometries) would point one of ordinary skill to the combination of tungsten trioxide having platelet morphology.

16. Appellant respectfully disagrees that Sherman teaches photocatalyst particles that have tungsten oxide having platelet morphology, or that it would be obvious to produce these particles. Sherman provides a list of photocatalytic particles for coating

the surfaces of core particles. The list of photocatalytic particles is only partially reflected in paragraph [0208] and many more additional compounds are listed in paragraph [0207]. Tungsten oxide is one of many. Sherman provides a list of shapes that include spheres, equiaxial, rod-like or platelet. Sherman mentions that preferably the shape is equiaxial or spherical. Importantly, Sherman does not associate tungsten oxide with platelets. Sherman only states that the photocatalyst can include tungsten oxide and that platelets is among the cited shapes. By contrast, Appellant's claim 10 drawn to tungsten oxide nanoparticles shaped like platelets is supported by an enabling and complete written description for their synthesis. In addition, Appellant explains that it is not typical for an anhydrous material to have the same morphology as the corresponding hydrate. Only by obtaining images of the particles at high magnification could one skilled in the art determine the morphology. Here, unexpectedly, the morphology for the anhydrous tungsten oxide was the same platelet type morphology as the precursor tungsten oxide monohydrate.

17. In summary, for the above reasons, Appellant submits claims 1-10 are allowable in view of the cited prior art. In view of the clear teachings of the application, Appellant urges that rejection of claims 1-10 be reversed.

Respectfully submitted,

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